

CHRISTOPHER D. HARVEY

Professor
Department of Neurobiology
Harvard Medical School
210 Longwood Ave, Armenise 417
Boston, MA 02115

Phone (office): 617-432-2297
Phone (cell): 516-527-0072
Email: harvey@hms.harvard.edu

EDUCATION

2008 Ph.D. Cold Spring Harbor Laboratory, NY
2003 B.S. Vanderbilt University, Nashville, TN
Majors in Biomedical Engineering and Molecular/Cellular Biology

PROFESSIONAL POSITIONS

2023 - Professor
Department of Neurobiology, Harvard Medical School, Boston, MA
2018 - 2023 Associate Professor
Department of Neurobiology, Harvard Medical School, Boston, MA
2012 - 2018 Assistant Professor
Department of Neurobiology, Harvard Medical School, Boston, MA
2008-2011 Postdoctoral Training
Advisor: David Tank, Princeton University, Princeton, NJ
2003-2008 Doctoral Training
Advisor: Karel Svoboda, Cold Spring Harbor Laboratory and Janelia Research Campus/HHMI

SELECTED HONORS, AWARDS, AND REVIEW ACTIVITIES

2024 National Academy of Sciences Troland Research Award
2022 Harvard Medical School Harold Amos Faculty Diversity Award
2020 NIH Director's Pioneer Award
2018 Society for Neuroscience Young Investigator Award
2015-2020 Biobehavioral Research Award for Innovative New Scientists (BRAINS), NIMH/NIH
2014-2016 Brain & Behavior Research Foundation Young Investigator Award
2014-2015 Armenise-Harvard Foundation Award
2013-2016 Searle Scholars Award
2013-2017 New York Stem Cell Foundation Robertson Neuroscience Investigator
2012-2014 Alfred P. Sloan Research Fellowship
2012-2016 Burroughs Wellcome Fund Career Award at the Scientific Interface
2010 Larry Katz Memorial Lecture, Cold Spring Harbor Laboratory
2009-2011 Helen Hay Whitney Postdoctoral Fellowship

Ad hoc reviewer for Nature, Science, Cell, Nature Neuroscience, Neuron, eLife, PNAS, Journal of Neuroscience, Current Biology, others.

Ad hoc member/reviewer: NIH/NINDS Board of Scientific Counselors; NIH BRAIN Initiative; Learning and Memory (LAM) Study Section; Sensory, Perceptual, and Cognitive Processes (SPC) Study Section

PEER-REVIEWED PUBLICATIONS (reverse chronological)

1. Kuan, A.T., Bondanelli, G., Driscoll, L.N., Han, J., Kim, M., Hildebrand, D.G.C., Graham, B.J., Wilson, D.E., Thomas, L.A., Panzeri, S.*, **Harvey, C.D.***, Lee, W.-C.A.* Synaptic wiring motifs in posterior parietal cortex support decision-making. *Nature*. 627, 367-373 (2024).
2. Green, J., Bruno, C.A., Traunmueller, L., Ding, J., Hrvatin, S., Wilson, D.E., Khodadad, T., Samuels, J., Greenberg, M.E., **Harvey, C.D.** A cell-type-specific error-correction signal in the posterior parietal cortex. *Nature*. 620, 366-373 (2023).
3. Kira, S., Morcos, A.S., Panzeri, S., **Harvey, C.D.** A distributed and efficient population code of mixed selectivity neurons for flexible navigation decisions. *Nature Communications*. (2023).
4. Chirila, A.M., Rankin, G., Tseng, S.Y., Emanuel, A.J., Chavez-Martinez, C.L., Zhang, D., **Harvey, C.D.**, Ginty, D.D. Mechanoreceptor signal convergence and transformation in the dorsal horn flexibly shape a diversity of outputs to the brain. *Cell*. 185, 4541-4559 (2022).
5. Driscoll, L.N., Duncker, L., **Harvey, C.D.** Representational drift: Emerging theories for continual learning and experimental future directions. *Current Opinion in Neurobiology*. (2022).
6. Pettit, N.L., Yap, E.L., Greenberg, M.E., **Harvey, C.D.** Fos ensembles encode and shape stable spatial maps in the hippocampus. *Nature*. 609, 327-334 (2022).
7. Arlt, C., Barroso-Luque, R., Kira, S., Bruno, C.A., Xia, N., Chettih, S.N., Soares, S., Pettit, N.L., **Harvey, C.D.** Cognitive experience alters cortical involvement in goal-directed navigation. *eLife*. (2022).
8. Tseng, S.-Y., Chettih, S.N., Arlt, C., Barroso-Luque, R., **Harvey, C.D.** Shared and specialized coding across posterior cortical areas for dynamic navigation decisions. *Neuron*. 110, 2484-2502 (2022).
9. Panzeri S., Moroni, M., Safaai, H., **Harvey, C.D.** The structures and functions of correlations in neural population codes. *Nature Reviews Neuroscience*. 23, 551-567 (2022).
10. Zhang, Z., Roberson, D.P., Kotoda, M., Boivin, B., Bohoslav, J.P., Gonzalez-Cano, R., Yarmolinsky, D.A., Lenfers Turnes, R., Wimalasena, N.K., Neufeld, S.Q., Barrett, L., Quintao, N.L.M., Fattori, V., Taub, D.G., Wiltschko, A.B., Andrews, N., **Harvey, C.D.**, Datta, S.R., Woolf, C.J. Automated preclinical detection of mechanical pain hypersensitivity and analgesia. *Pain*. 163, 2326-2336 (2022).
11. Pettit, N.L., Yuan, X.C., **Harvey, C.D.** Hippocampal place codes are gated by behavioral engagement. *Nature Neuroscience*. 25, 561-566 (2022).
12. Emanuel, A.J., Lehnert, B.P., Panzeri, S., **Harvey, C.D.**, Ginty, D.D. Cortical responses to touch reflect subcortical integration of LTMR signals. *Nature*. 600, 680-685 (2021).
13. Lehnert, B.P., Santiago, C., Huey, E.L., Emanuel, A.J., Renauld, S., Africawala, N., Alkisar, I., Zheng, Y., Bai, L., Charalampia, K., Hong, J.T., Magee, A.R., **Harvey, C.D.**, Ginty, D.D. Mechanoreceptor synapses in the brainstem shape the central representation of touch. *Cell*. 184, 5608-5621 (2021).

14. Bohnslav, J.P., Wimalasena, N.K., Clausing, K.J., Dai, Y.Y., Yarmolinsky, D.A., Cruz, T., Kashlan, A.D., Chiappe, M.E., Orefice, L.L., Woolf, C.J., **Harvey, C.D.** DeepEthogram, a machine learning pipeline for supervised behavior classification from raw pixels. *eLife*. (2021).
15. Valente, M., Pica, G., Bondanelli, G., Moroni, M., Runyan, C.A., Morcos, A.S., **Harvey, C.D.**, Panzeri, S. Correlations enhance the behavioral readout of neural population activity in association cortex. *Nature Neuroscience*. 24, 975-986 (2021).
16. Kafashan, M., Jaffe, A.W., Chettih, S.N., Nogueira, R., Arandia-Romero, I., **Harvey, C.D.**, Moreno-Bote, R., Drugowitsch, J. Scaling of sensory information in large neural populations shows signatures of information-limiting correlations. *Nature Communications*. (2021).
17. Yap, E-L., Pettit, N.L., Davis, C.P., Nagy, A., Harmin, D.A., Golden, E., Lin, C., Rudolph, S., Sharma, N., Griffith, E.C., **Harvey, C.D.**, Greenberg, M.E. Bidirectional perisomatic inhibitory plasticity of *Fos*-activated neuronal network. *Nature*. 590, 115-121 (2020).
18. Rule, M.E., Loback, A.R., Raman, D.V., Driscoll, L.N., **Harvey, C.D.**, O'Leary, T. Stable task information from an unstable neural population. *eLife*. (2020).
19. Neubarth, N.L., Emanuel, A.J., Liu, Y., Springel, M.W., Handler, A., Zhang, Q., Lehnert, B.P., Guo, C., Orefice, L.L., Abdelaziz, A., DeLisle, M.M., Iskols, M., Rhyins, J., Kim, S.J., Cattel, S.J., Regehr, W., **Harvey, C.D.**, Drugowitsch, J., Ginty, D.D. Meissner corpuscles and their spatially intermingled afferents underlie gentle touch perception. *Science*. 368, 6497 (2020).
20. Rule, M.E., O'Leary, T., **Harvey, C.D.** Causes and consequences of representational drift. *Curr Opin Neurobiol*. 58, 141-147 (2019).
21. Hrvatin, S., Tzeng, C.P., Nagy, M.A., Stroud, H., Koutsoumpa, C., Wilcox, O.F., Assad, E.G., Green, J., **Harvey, C.D.**, Griffith, E.C., Greenberg, M.E. A scalable platform for the development of cell-type-specific viral drivers. *eLife*. (2019).
22. Chettih, S.N. and **Harvey, C.D.** Single-neuron perturbations reveal feature-specific competition in V1. *Nature*. 567, 334-340 (2019).
23. Minderer, M., Brown, K.D., **Harvey, C.D.** The spatial structure of neural encoding in mouse posterior cortex during navigation. *Neuron*. 102, 232-248 (2019).
24. Adam, Y., Kim, J.J., Lou, S., Zhao, Y., Xie, M.E., Brinks, D. Wu, H., Mostajo-Radji, M.A., Kheifets, S., Parot, V., Chettih, S., Williams, K.J., Gmeiner, B., Farhi, S.L., Madisen, L., Buchanan, E.K., Kinsella, I., Zhou, D., Paninski, L., **Harvey, C.D.**, Zeng, H., Arlotta, P., Campbell, R.E., Cohen, A.E. Voltage imaging and optogenetics reveal behaviour-dependent changes in hippocampal dynamics. *Nature*. 569, 413-417 (2019).
25. Spaen, Q., Asin-Acha, R., Chettih, S.N., Minderer, M., **Harvey, C.D.**, Hochbaum, D.S. HNCorr: A novel combinatorial approach for cell identification in calcium-imaging movies. *eNeuro*. 6, 1-19 (2019).
26. Safaai, H., Onken, A., **Harvey, C.D.**, Panzeri, S. Information estimation using non-parametric copulas. *Physical Review E*. 98, 201811 (2018).
27. Jackman, S.L., Chen, C.H., Chettih, S.N., Neufeld, S.Q., Drew, I.R., Agba, C.K., Flaquer, I., Stefano, A.N., Kennedy, T.J., Belinsky, J.E., Roberston, K., Beron, C.C., Sabatini, B.L., **Harvey, C.D.**, Regehr, W.G. Silk fibroin films facilitate single-step targeted expression of optogenetic proteins. *Cell Reports*. 22, 3351-3361 (2018).
28. Driscoll, L.N., Pettit, N.L., Minderer, M., Chettih, S.N., **Harvey, C.D.** Dynamic reorganization of neuronal activity patterns in parietal cortex. *Cell*. 170, 986-999 (2017).

29. Runyan, C.A., Piasini, E., Panzeri, S., **Harvey, C.D.** Distinct timescales of population coding across cortex. *Nature*. 548, 92-96 (2017).
30. Panzeri, S., **Harvey, C.D.**, Piasini, E., Latham, P.E., Fellin, T. Cracking the neural code for sensory perception by combining statistics, intervention, and behavior. *Neuron*. 93, 491-507 (2017).
31. Pica, G., Piasini, E., Safaai, H., Runyan, C.A., Diamond, M.E., Fellin, T., Kayser, C., **Harvey, C.D.**, Panzeri, S. Quantifying how much sensory information in a neural code is relevant for behavior. *Neural Information Processing Systems (NeurIPS)*. (2017).
32. Morcos, A.S. and **Harvey, C.D.** History-dependent variability in population dynamics during evidence accumulation in cortex. *Nature Neuroscience* 19, 1672-1681 (2016).
33. Rajan, K., **Harvey, C.D.**, Tank, D.W. Recurrent network models of sequence generation and memory. *Neuron*. 90, 128-142 (2016).
34. **Harvey, C.D.**, Coen, P., Tank, D.W. Choice-specific sequences in parietal cortex during a virtual-navigation decision task. *Nature*. 484, 62-68 (2012).
35. Dombeck, D.A., **Harvey, C.D.**, Tian, L., Looger, L.L., Tank, D.W. Functional imaging of hippocampal place cells at cellular resolution during virtual navigation. *Nature Neurosci.* 13, 1433-1440 (2010).
36. **Harvey, C.D.**, Collman, F., Dombeck, D.A., Tank, D.W. Intracellular dynamics of hippocampal place cells during virtual navigation. *Nature*. 461, 941-946 (2009).
37. **Harvey, C.D.**, Ehrhardt, A.G., Cellulare, C., Zhong, H., Yasuda, R., Davis R.J., Svoboda, K. A genetically-encoded fluorescent sensor of ERK activity. *Proc Natl Acad Sci*. 105, 19264-19269 (2008).
38. **Harvey, C.D.**, Yasuda, R., Zhong, H., Svoboda, K. The spread of Ras activity triggered by activation of a single dendritic spine. *Science*. 321, 136-140 (2008).
39. **Harvey, C.D.** and Svoboda, K. Locally dynamic synaptic learning rules in pyramidal neuron dendrites. *Nature*. 450, 1195-1200 (2007).
40. Yasuda, R., **Harvey, C.D.**, Zhong, H., Sobczyk, A., van Aelst, L., Svoboda, K. Supersensitive Ras activation in dendrites and spines revealed by two-photon fluorescence lifetime imaging. *Nature Neurosci.* 9, 283-291 (2006).
41. Li, J., Hawkins, I.C., **Harvey, C.D.**, Jennings, J.L., Link, A.J., Patton, J.G. Regulation of alternative splicing by SRp86 and its interacting proteins. *Mol Cell Biol*. 23, 7437-7447 (2003).

PRE-PRINTS

1. Safaai, H., Wang, A.Y., Kira, S., Malerba, S.B., Panzeri, S., **Harvey, C.D.** Specialized structure of neural population codes in parietal cortex outputs. *bioRxiv* (2023).
2. Bohoslav, J.P., Osman, M.A.M., Jaggi, A., Soares, S., Weinreb, C. Datta, S.R., **Harvey, C.D.** ArMo: an articulated mesh approach for mouse 3D reconstruction. *bioRxiv* (2023).

OTHER PUBLICATIONS

- Minderer M. and **Harvey, C.D.** Virtual reality explored: The best of both worlds. *Nature*. 533, 324-325 (2016).

MENTORSHIP

Current	Postdoctoral Fellows:	Jennifer Ding, Jonathan Green, Shinichiro Kira, Kevin Mizes, Barbara Peysakhovich, Houman Safaai, Sofia Soares, Daniel Wilson
	Graduate Students:	Destinee Aponte, Yasmine Ayman, Tarek Jabri, Akshay Jaggi, Henry Kyoung Cindy Yuan, Hanwen (Lily) Zhang, Siyan Zhou
	Research Assistant:	Chelsea Mapp, Erin Tam, Helen Yang
Former	Postdoctoral Fellows:	Charlotte Arlt (now Editor at Nature Neuroscience) Alan Emanuel (now Assistant Professor at Emory University) Caroline Runyan (now Associate Professor, University of Pittsburgh) Alice Wang (now Research Lead Scientist at Spotify)
	Graduate Students:	Jim Robinson-Bohnslav (now, Research Engineer at Perceptive Automata) Laura Driscoll (now Postdoc, Stanford University) Selmaan Chettih (now Postdoc, Columbia University) Anna Jaffe (now, Data Scientist at Stripe) Noah Pettit (now Postdoc, Harvard Medical School) Matthias Minderer (now AI resident at Google Brain) Ari Morcos (now Research Scientist at Facebook AI Research) Shih-Yi Tseng (now Postdoc, UCSF)

FUNDING

Current	NIH Pioneer Award	DP1 MH125776	2020-2025
	Toward mechanistic cognitive neuroscience: cell types, connectivity, and patterned perturbations		
	NINDS / NIH	R01 NS089521	2020-2025
	Parietal cortex networks for sensorimotor processing during navigation		
Past	NIH BRAIN Initiative	R01 NS108410	2018-2023
	Studying perceptual decision-making across cortex by combining population imaging, connectomics, and computational modeling		
	Human Frontier Science Program		2017-2021
	Building a theory of shifting representations in the mammalian brain		
	NIMH / NIH	R01 MH107620	2015-2020
	New approaches to understand neuronal microcircuit dynamics for working memory		
	NYSCF Robertson Neuroscience Investigator		2013-2017
	Optical dissection of mouse decision-making circuits in virtual reality		
	Burroughs Wellcome Fund Career Award at the Scientific Interface		2012-2016
	Dissecting the neural circuit mechanisms underlying decision-making in mice		
	Searle Scholars Award		2013-2016
	Plasticity of neural circuit dynamics in the mouse cortex during learning		

Simons Foundation Autism Research Initiative Optical imaging of circuit dynamics in autism models in virtual reality	2014-2016
NARSAD Brain and Behavior Research Imaging information flow in cortical circuits during cognitive processing	2014-2016
Helen Hay Whitney Postdoctoral Fellowship	2008-2011